

dNTSC Data Broadcasting

**dNTSC Compatibility with
Adjacent and Co-Channel DTV Stations**

Summary of Test Results

Document No. 02-31

**Advanced Television Technology Center
1330 Braddock Place, Suite 200
Alexandria, VA 22314-1650
(703) 739-3850
(703) 739-3230 (Fax)
www.attc.org**

© 2002 ATTC, Inc.

Table of Contents

1 INTRODUCTION	1
1.1 Background	1
1.2 Document Scope	1
1.3 Related Documents	1
2 TEST PROGRAM OVERVIEW	3
2.1 Objectives	3
2.2 Test Methodologies	3
2.3 Test Conditions	3
2.4 Evaluation Methodology	3
3 DESCRIPTION OF TEST SETUP	5
3.1 dNTSC System Under Test	5
3.2 Test System	5
3.3 DTV Receivers Under Test	6
3.4 RF Signals	6
4 SUMMARY OF TEST RESULTS	8
4.1 Main Test Results	8
4.2 Additional Test Results	22

Table of Figures

Figure 3-1 Simplified Flow Diagram of Test Setup.....	5
Figure 4-1 Test Results Summary: TOV Of All Six Receivers In Nine Reception Conditions. with dNTSC Off and On.....	11
Figure 4-2 Test Results Summary: TOV Of All Six Receivers In Nine Reception Conditions. with dNTSC Off and On.....	1%
Figure 4-3 Strong DTV Desired; NTSC Co-Channel Undesired	13
Figure 4-4 Moderate DTV Desired; NTSC Co-Channel Undesired.....	14
Figure 4-5 Weak DTV Desired; NTSC Co-Channel Undesired.....	15
Figure 4-6 Strong DTV Desired; NTSC Lower First Adjacent Undesired	16
Figure 4-7 Moderate DTV Desired; NTSC Lower First Adjacent Undesired	17
Figure 4-8 Weak DTV Desired; NTSC Lower First Adjacent Undesired.....	18
Figure 4-9 Strong DTV Desired; NTSC Upper First Adjacent Undesired.....	19
Figure 4-10 Moderate DTV Desired; NTSC Upper First Adjacent Undesired	20
Figure 4-11 Weak DTV Desired; NTSC Upper First Adjacent Undesired.....	21
Figure 4-12 Receiver A: Co-Channel Re-Tests At -26dB Injection.....	23
Figure 4-13 Receiver E: Co-Channel Re-Test At -26dB dNTSC Visual Injection	24
Figure 4-14 Receiver E: Upper Adjacent Channel Re-Test At -26dB Injection	25

List of Tables

Table 3-1 List of Receivers Under Test.....	6
Table 3-2 DTV Signal Configuration (Desired Channel).....	6
Table 3-4 NTSC Signal Configuration (Undesired Channel).....	6
Table 4-1 Reception Conditions For Each Receiver Under Test	8
Table 4-2 Conditions Re-tested At -26dB Injection Level	9
Table 4-3 Test Results Summary: Median TOV (dB) Performance Of All Six Receivers In Nine Reception Conditions, with dNTSC Off and On	11
Table 4.4 Test Results Summary: Median TOV (dB) Performance Of All <i>Six</i> Receivers In Nine Reception Conditions, with dNTSC Off and On	12
Table 4-5 Strong DTV Desired: NTSC Co-Channel Undesired	13
Table 4-6 Moderate DTV Desired; NTSC Co-Channel Undesired	14
Table 4-7 Weak DTV Desired; NTSC Co-Channel Undesired	15
Table 4-8 Strong DTV Desired; NTSC Lower First Adjacent Undesired.....	16
Table 4-9 Moderate DTV Desired NTSC Lower First Adjacent Undesired	17
Table 4-10 Weak DTV Desired; NTSC Lower First Adjacent Undesired	18
Table 4-11 Strong DTV Desired; NTSC Upper First Adjacent Undesired.....	19
Table 4-12 Moderate DTV Desired; NTSC Upper First Adjacent Undesired.....	20
Table 4-13 Weak DTV Desired; NTSC Upper First Adjacent Undesired	21
Table 4-14 Receiver A: Co-Channel Re-Tests At -26dB Injection	25
Table 4-15 Receiver E: Co-Channel Re-Test At -26dB Injection	24
Table 4.16 Receiver E: Upper Adjacent Channel Re-Test At -26dB Injection.....	25

1 Introduction

1.1 Background

Dotcast, Inc. has developed a unique system that allows television broadcasters to transmit up to 5.7Mbps of data within their existing analog NTSC service. The Dotcast system of adding a data subcarrier to NTSC is known as dNTSC™. Since the data is carried within the current NTSC TV channel allocations, there is a need to quantify any impact that the dNTSC system may have on existing services in the broadcast TV band. This type of testing has been commonly referred to as *compatibility* testing.

ATTC has been contracted by Dotcast to perform independent, third party laboratory tests on the dNTSC system. Prior tests, conducted in Oct. 2001 and Feb. 2002, were designed to evaluate whether dNTSC significantly impacts the video and audio quality of a *host* NTSC station (i.e. if a broadcaster implements dNTSC, would this impact the picture or sound quality of his own station?)

Currently, there is a need to perform additional compatibility tests to determine whether dNTSC affects *other* TV stations in the broadcast band (i.e. if a broadcaster implements dNTSC, would this affect the picture or sound quality of *other* TV stations?). In this case, the "other" stations will be transmitting DTV (additional tests to evaluate dNTSC compatibility with other *NTSC* stations have been completed, and are currently under analysis).

1.2 Document Scope

This document contains a summary of test program objectives, methodologies, and test results for all DTV Compatibility tests performed within the third part of the dNTSC test program.

1.3 Related Documents

For additional information regarding the detailed test *procedures* used in *this* phase of the test program, the reader is encouraged to refer to:

ATTC Doc. #02-30, dNTSC Data Broadcasting, dNTSC Compatibility with Adjacent and Co-Channel DTV and NTSC Stations, Test Plan and Procedures, December 2002

Readers of this test report may also be interested in previous elements of the dNTSC test program. For further information, please refer to the following documents:

ATTC Doc. #02-05, dNTSC Data Broadcasting, Subjective Aural Compatibility Tests of the Dotcast dNTSC System, Test Plan and Procedures, February 2002

ATTC Doc. #02-06, dNTSC Data Broadcasting, Subjective Aural Compatibility Tests of the Dotcast dNTSC System, Summary of Test Results, February 2002

ATTC Doc. #01-18, dNTSC Data Broadcasting, Host NTSC Channel Compatibility of the Dotcast dNTSC System, Summary of Test Results, October 19, 2001

Advanced Television Technology Center

ATTC Doc #01-17, dNTSC Data Broadcasting, Tier I - Test Plan, October 19, 2001

2 Test Program Overview

2.1 Objectives

The primary objective of the laboratory tests was: “Quantify the impact, if any, of dNTSC data signals on adjacent channel and co-channel 8-VSB DTV signals”. This objective was met through a class of tests commonly referred to as *compatibility testing*.

2.2 Test Methodologies

In compatibility testing methodologies, various “real-world television reception conditions and broadcast station configurations are emulated in a series of controlled laboratory tests. In each of these reception conditions, the performance of consumer DTV receivers is evaluated.

Initially, the test is executed with dNTSC turned off. The test is then executed again, under identical reception conditions, but with dNTSC turned on. The difference between these two sets of test results may then be used to quantify the impact of dNTSC. The *primary test variable*, therefore, is the presence or absence of a dNTSC signal in each television reception condition.

2.3 Test Conditions

Compatibility testing may include a wide variety of television *reception conditions*. For this portion of the dNTSC test program, the reception conditions included lower first adjacent, upper first adjacent, and co-channel interference conditions. Each of these interference conditions was evaluated in three different desired channel RF signal strengths (strong, moderate and weak). No additional multipath or noise was added to the channel.

2.4 Evaluation Methodology

There are generally two classes of methodologies which may be used to evaluate the reception performance of DTV receivers under the test conditions outlined above. These evaluation methodologies may be defined as: 1) Objective evaluation 2) Subjective evaluation.

Objective evaluation methods typically employ Bit-Error-Rate (BER) measurements to precisely count the number of bit errors that occur within a given time interval. This technique requires test instrumentation that keeps a running tally of bit patterns received. Other variations on this method, including symbol error rate, may also be used.

Subjective evaluation methods, on the other hand, are comprised of test methodologies that use the human auditory and visual systems as the primary measuring “instrument”. These methods may incorporate viewing tests, listening tests or some other procedure in order to evaluate the “overall quality” as perceived by a human viewer or listener.

Since the consumer DTV receivers under test could not be readily interfaced with conventional BER test equipment, subjective evaluation methods were employed exclusively. However, the subjective evaluation procedures used with DTV are quite

different than traditional subjective measurements. due to DTV's well-known "cliff effect" failure mode. The cliff effect makes it easy for trained human subjects to unequivocally identify the point of DTV degradation/failure. Consequently, subjective DTV tests exhibit good repeatability between test subjects (viewers).

Nonetheless, in order to achieve consistent and repeatable test results, the subjective test procedure must be precisely defined. For all tests, the Threshold of Visibility (TOV) is defined as the Desired-undesired ratio (D/U) which results in the onset of visible errors in the DTV picture. A DTV picture is considered to be "at TOV" when an expert/trained viewer observes at *least* one error within a 20 second observation window, over a period of *three consecutive* 20 second observation windows. Additional methodology details may be found in the test plan documentation.

3 Description of Test Setup

3.1 dNTSC System Under Test

The Dotcast dNTSC system was configured to operate on both the aural and visual carriers of the undesired (interfering) NTSC station. In general, the hardware and software of the dNTSC system was the same as used in previous elements of the test program, including prior "host compatibility" tests. *However*, one substantial change was made to the dNTSC visual data system. The signal spectrum of the dNTSC visual data was shifted approximately 62.8kHz from its previous location, such that the outer edge of the dNTSC signal was 62.8kHz farther away from the lower channel edge than in the previous host compatibility tests.

3.2 Test System

ATTC configured an NTSC/dNTSC/DTV television test platform to perform all necessary tests. This test platform included a wide variety of baseband and RF audio and video equipment, configured to simulate two typical TV broadcast stations. Figure 3-1 depicts a highly simplified flow diagram of the laboratory test platform. Additional details about the test platform hardware may be found in the test procedures. In most cases, the component video outputs of the DTV set-top-box under test were connected to a direct view high definition display. In cases where the DTV tuner was "integrated with the display device (e.g. the Sony KD-34XBR2), the television set's native display was used.

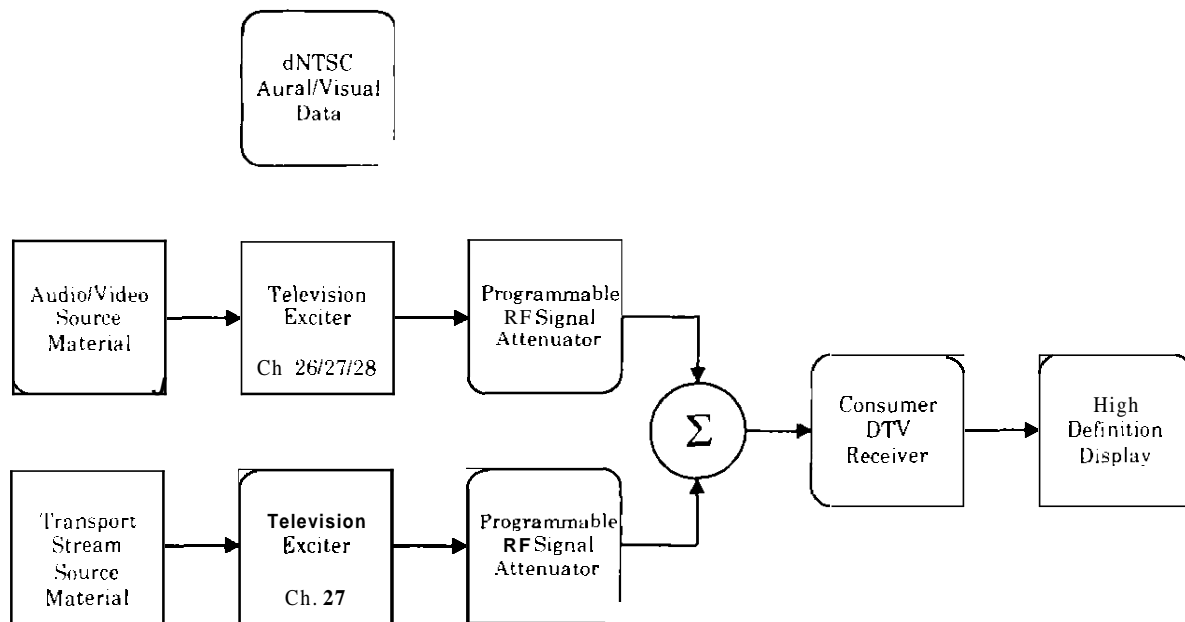


Figure 3-1 Simplified Flow Diagram of Test Setup

3.3 DTV Receivers Under Test

A total of six consumer DTV television receivers were included in the test program. ATTC purchased each of the receivers via typical consumer outlets (i.e. local retailers and the Internet). This method ensured that the sample represented receivers that have actually been deployed in the field (there were no special, prototypical, or "next generation" receivers included in the study). ATTC made every effort to obtain receivers from as many manufacturers as possible through normal consumer purchasing channels. Further research indicated that the final selection of receivers employed a diverse set of 8VSB demodulation "chips" – including demodulation chips from both Broadcom and NxtWave. These receivers are hereafter referred to as Receivers A thru F. Table 3-1 enumerates the make and model of each receiver.

Note that the order of this table does **not** imply which make & model correspond to receiver designations "A" through "F" (i.e. Row 1 is not necessarily Receiver "A").

Table 3-1 List of Receivers Under Test

Type	Make	Model	Serial #	Source	Mfg Date
DTV/Satellite set-top-box	RCA	DTC-100	112619241	RCA (website)	
DTV/Satellite set-top-box	EchoStar	6000T	RAECHM03634C	Dish Depot (website)	
DTV set-top-box	Samsung	SIR-T150	31HT300272J	Best Buy (website)	March 2002
DTV/Satellite set-top-box	Toshiba	DST-3000	T33A48196A1B	Best Buy (local retailer)	
DTV/Satellite set-top-box	Zenith	DTV1080	1A1-12450218	Belmont TV (local retailer)	Nov 2001
DTV Set w/ Integrated Tuner	Sony	KD-34XBR2		Myer-Emco (local retailer)	Nov 2001

3.4 RF Signals

Table 3-2 and Table 3-3 tabulate the configuration of the broadcast television signals used for all tests. Note that in "dNTSC Off" test conditions, both the aural and visual dNTSC DDS data signals were completely removed/bypassed.

Table 3-2 DTV Signal Configuration (Desired Channel)

RF Characteristics			Audio/Video Characteristics	
Description	Value	Unit	Description	Value
Type	ATSC 8-VSB		MPEG Transport Stream Name	Zone Plate
Channel*	27			
Average Power				
• "Strong"	28	dBm		
• "Moderate"	-53	dBm		
• "Weak"	-68	dBm		

*In cases where the DTV signal is to be tested in conjunction with a lower first adjacent NTSC signal, the DTV signal will be offset in frequency, such that the DTV pilot is 5.082138MHz above the

Advanced Television Technology Center

NTSC **visual** carrier frequency. This translates to a +22.697kHz offset from the nominal DTV channel frequency. This practice is consistent with the FCC rules as described in FCC 73.622.

Table 3-3 NTSC Signal Configuration (Undesired Channel)

RF Characteristics			Audio Characteristics	
Description	Value	Unit	Description	Value
Type	NTSC		Type	Mono
Channel	26, 27, 28		Main Audio	Silence
Visual-Aural Ratio	20	%	Total Deviation (peak)	0 kHz
Peak Power	Variable		Main Audio Processing	NA
dNTSC Data Characteristics*			Video Characteristics	
Description	Value	Unit	Description	Value
Aural DDS Rate (Raw)	1.43	Mbps	Picture	M16/Rotating Pyramids
Aural DDS Injection	25	%		
Visual DDS Rate (Raw)	4.29	Mbps		
Visual DDS Injection	-24	dB		
Visual DDS Mod	128QAM			

*In test conditions where dNTSC is specified as *off*, these parameters do not apply

4 Summary of Test Results

4.1 Main Test Results

Reception Conditions Tested

Each DTV receiver was tested in a total of eighteen reception conditions, with dNTSC DDS data present (dNTSC On) and absent (dNTSC Off) on the interfering NTSC signal. Table 4-1 tabulates all eighteen test conditions.

Table 4-1 Reception Conditions **For** Each Receiver Under Test

NTSC Interference Type	DTV Power	dNTSC Off/On
Co-Channel	Strong	dNTSC Off
		dNTSC On
	Moderate	dNTSC Off
		dNTSC On
	Weak	dNTSC Off
		dNTSC On
Lower First Adjacent	Strong	dNTSC Off
		dNTSC On
	Moderate	dNTSC Off
		dNTSC On
	Weak	dNTSC Off
		dNTSC On
Upper First Adjacent	Strong	dNTSC Off
		dNTSC On
	Moderate	dNTSC Off
		dNTSC On
	Weak	dNTSC Off
		dNTSC On

As discussed in section 2.4 and the test plan documentation, reception was tested in each interference condition between 4 and 7 times (4.7 trials)¹. The statistical *median* of all trials performed in a given interference condition should be taken as the final test result.

All tests were initially performed at a –24dB dNTSC visual injection level², which is 2dB *higher* than Dotcast's nominal operating injection level of –26dB. Several tests were also repeated at the normal –26dB injection level. Two receivers (Receiver A and Receiver E) were re-tested at a –26dB

¹ Specifically, each test was conducted a maximum of 7 times (7 trials). However, if the same numeric test result was obtained 4 times, no further trials were deemed necessary, because further trials would not affect the *median* test result.

² Where injection level is the average power of the dNTSC data subcarrier relative to the NTSC peak of sync power.

dNTSC visual injection level, in certain co-channel and upper adjacent interference conditions (note that the aural injection level was *unchanged*). Table 4-2 tabulates the conditions re-tested at the -26dB injection level.

Table 4-2 Conditions Re-Tested At -26dB Injection Level

NTSC Interference Type	DTV Power	Receiver
Co-Channel	Strong	Rcvr A
	Moderate	Rcvr A
	Weak	Rcvrs A & E
Upper First	Weak	Rcvr E

Test Results Summary

Table 4-3 and Figure 4-1 summarize the test results for all receivers, in all eighteen test conditions. Each dot on these figures represents the performance of *one receiver*. The horizontal bars on the plot indicate the median performance for all six receivers in a given condition. Note that this data contains a mixture of test results for both -24dB and -26dB dNTSC injection levels". The -26dB injection level cases are enumerated in Table 4.2 (above). If the test condition is not listed in Table 4-2, then it may be assumed that the test was performed at the -24dB injection level.

Table 4-4 and Figure 4-2 summarize the results in the same manner as the previous data of Table 4-3 and Figure 4-1. *Howeuer*, these tables and plots include *only* test results data for the -24dB injection level case.

Table 4-5 through Table 4-13 and Figure 4-3 through Figure 4-11 break down the test results receiver by receiver, and show *all trials* for each reception condition and each receiver. Note that on these plots, each dot represents a single *trial*, and the horizontal bars indicate the median of all trials for the receiver.

The reader should note that the statistical nature of digital communication systems and the behavior of certain DTV receivers results in some measurement variation from trial to trial. The measurement resolution is therefore limited by the test methodology, and variations within 1dB should be considered "measurement noise".

Once the -24dB injection level tests were completed, it was noted that in most cases there was no significant difference between dNTSC *off* and dNTSC *On*. Consequently, only the few test cases exhibiting a measurable response to dNTSC were re-tested at the -26dB injection level.

Data On This Page Taken At Both -24dB and -26dB dNTSC Injection (See Table 4-2)

Table 4-3 Test Results Summary: Median TOV (dB) Performance Of All Six Receivers In Nine Reception Conditions, with dNTSC Off and On

Data taken at -24dB and -26dB injection	Strong DTV Desired		Moderate DTV Desired		Weak DTV Desired	
	dNTSC Off	dNTSC On	dNTSC Off	dNTSC On	dNTSC Off	dNTSC On
NTSC Co-Channel Undesired	2.63	3.38	2.50	3.38	2.88	3.88
NTSC Lower First Undesired	-25.00	-24.88	-33.75	-33.38	-37.25	-37.00
NTSC Upper First Undesired	-26.00	-26.00	-34.50	-37.38	-38.88	-38.75

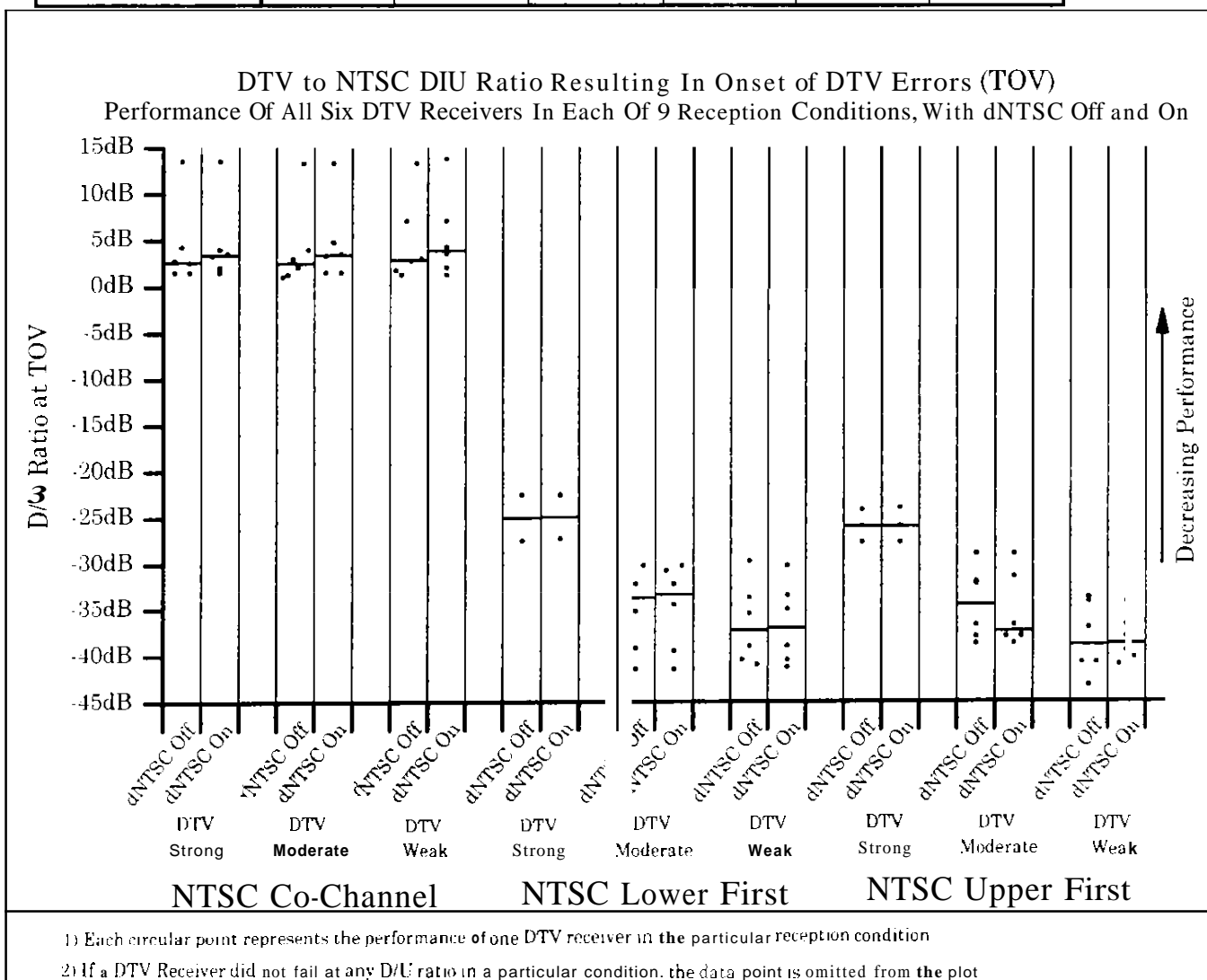


Figure 4-1 Test Results Summary: TOV Of All Six Receivers In Nine Reception Conditions, with dNTSC Off and On

All Data On This Page Taken With -24dB dNTSC Injection

Table 4-4 Test Results Summary: Median TOV (dB) Performance Of All Six Receivers In Nine Reception Conditions, with dNTSC Off and On

	Strong DTV Desired		Moderate DTV Desired		Weak DTV Desired	
	dNTSC Off	dNTSC On	dNTSC Off	dNTSC On	dNTSC Off	dNTSC On
NTSC Co-Channel Undesired	2.63	3.38	2.50	3.75	2.88	5.13
NTSC Lower First Undesired	-25.00	-24.88	-33.75	-33.38	-37.25	-37.00
NTSC Upper First Undesired	-26.00	-26.00	-34.50	-37.38	-38.88	-38.63

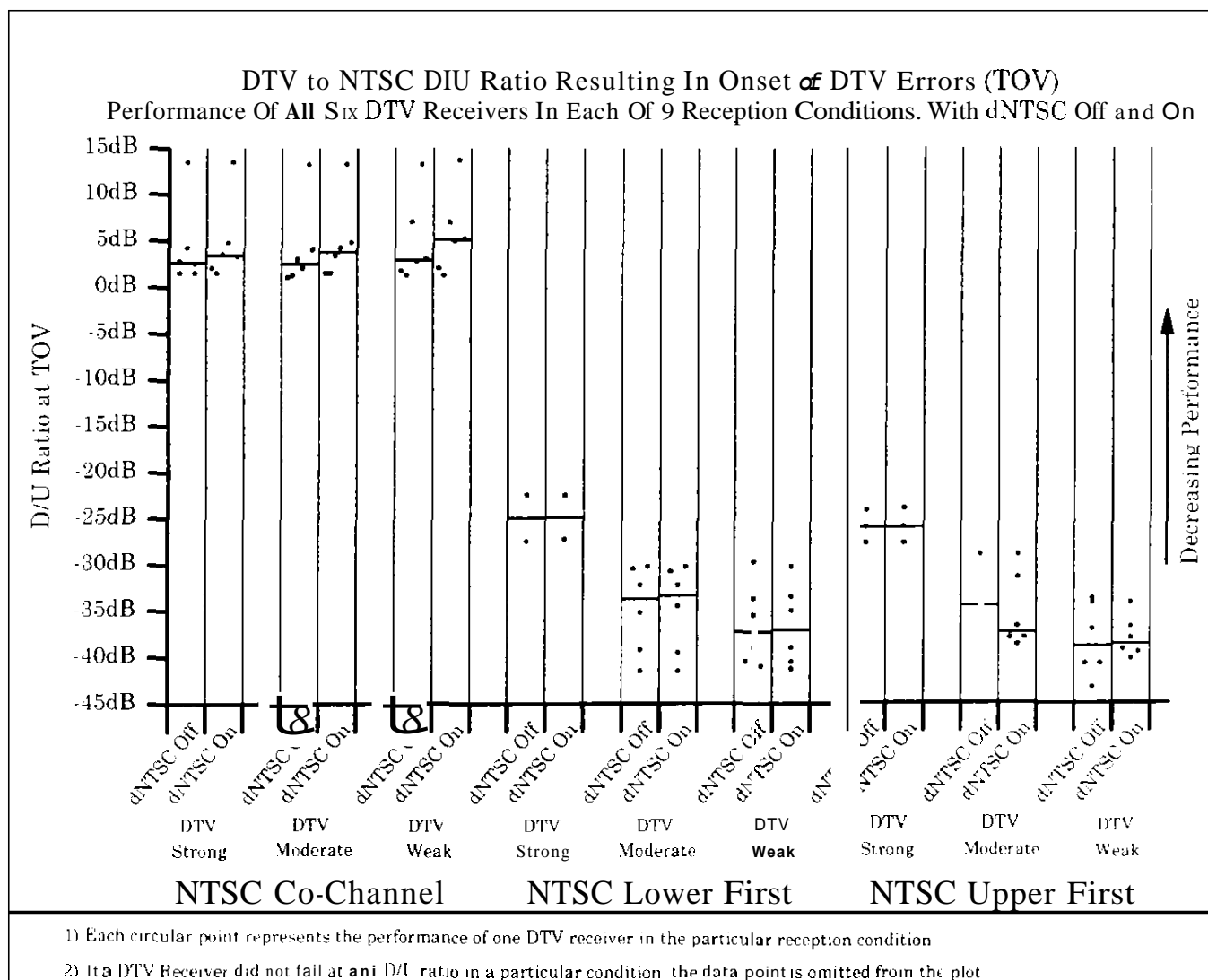
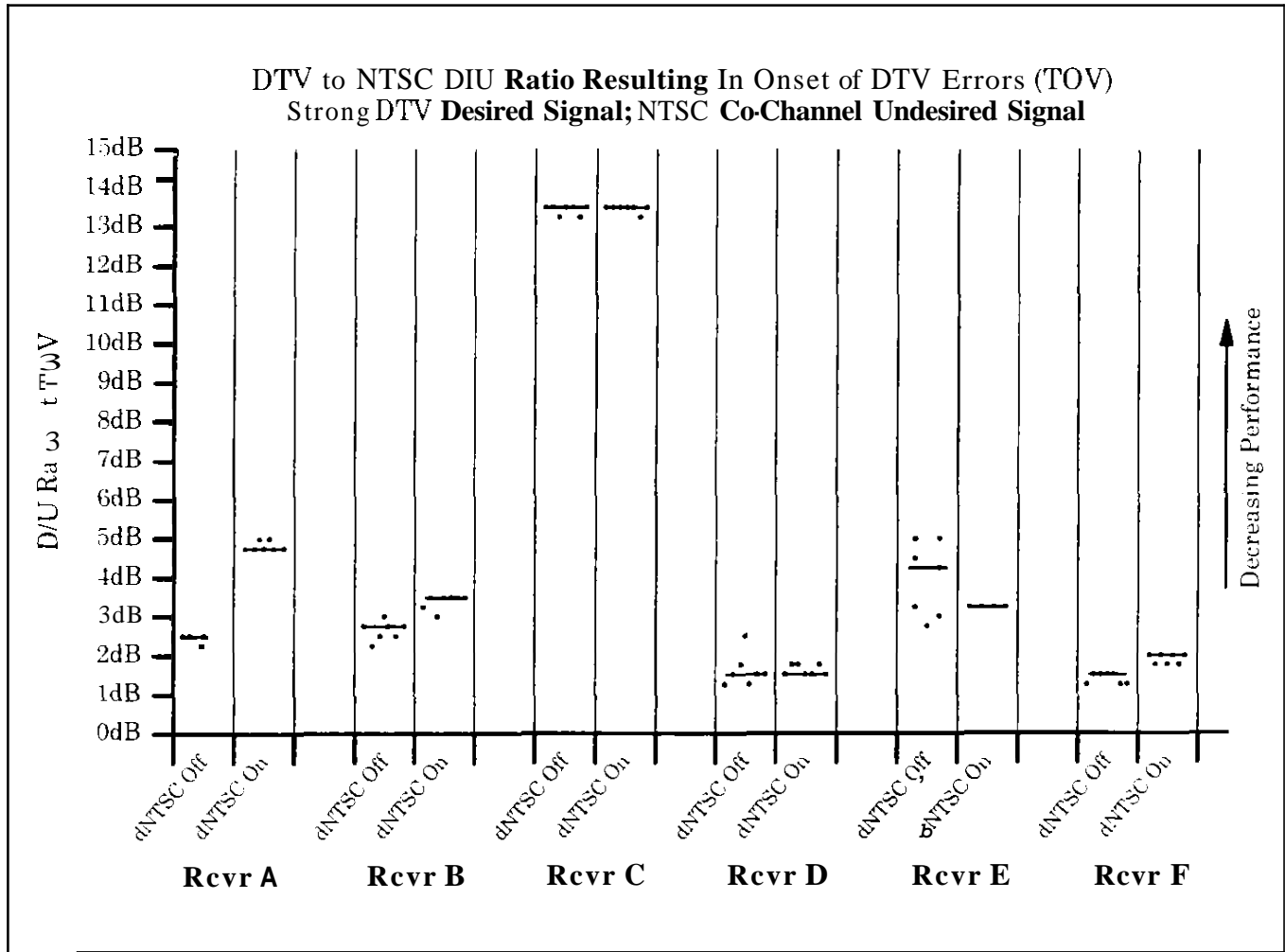


Figure 4-2 Test Results Summary: TOV Of All Six Receivers In Nine Reception Conditions, with dNTSC Off and On

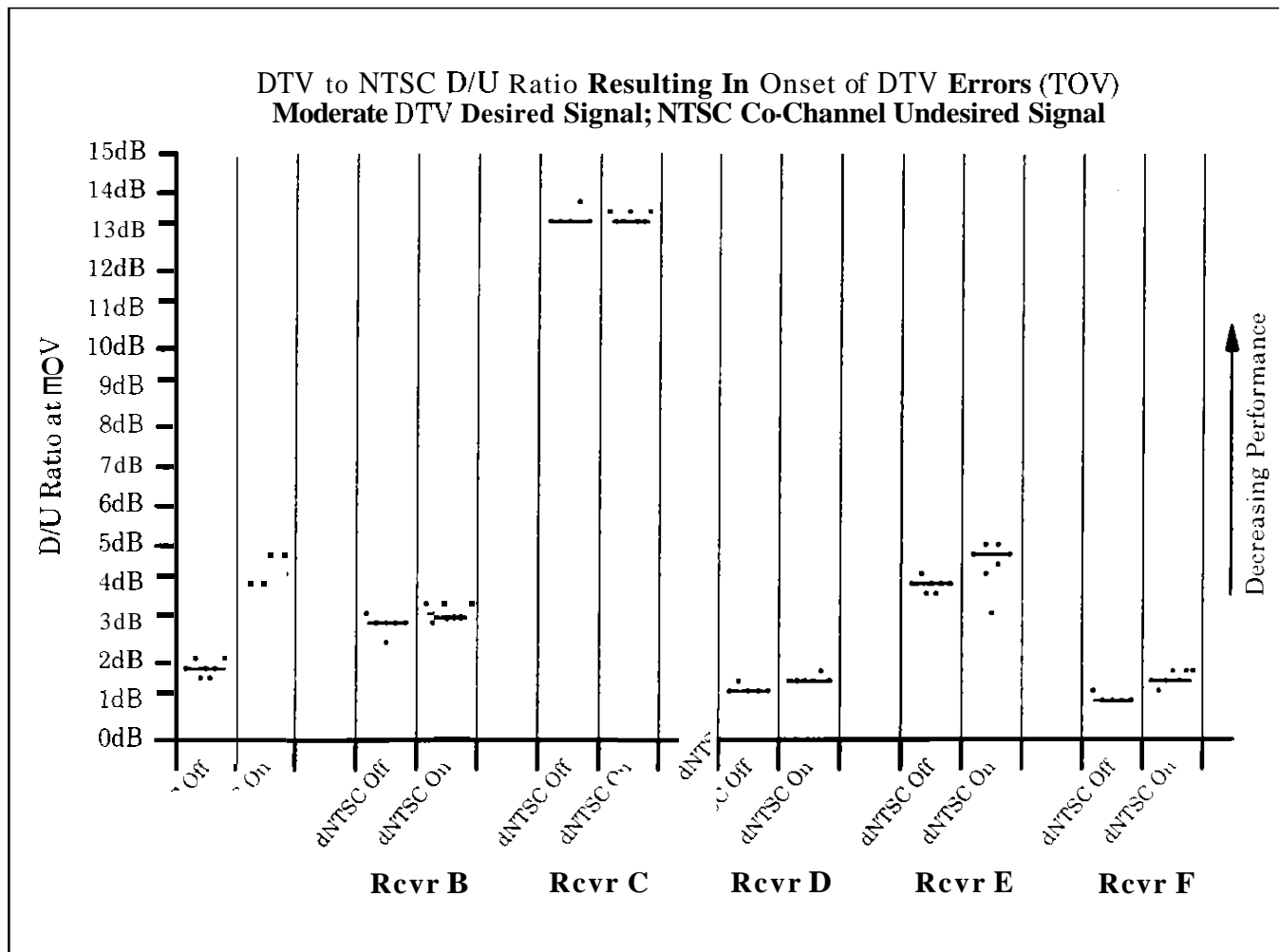
All Data On This Page Taken With -24dB dNTSC Injection

	Rcvr 4		Rcvr B		Rcvr C		Rcvr D		Rcvr E		Rcvr F	
	dNTSC Off	dNTSC On	dNTSC Off	dNTSC On	dNTSC Off	dNTSC On	dNTSC Off	dNTSC On	dNTSC Off	dNTSC On	dNTSC Off	dNTSC On
D/U(dB) at TOV (Median)	2.50	4.75	2.75	3.50	13.50	13.50	1.50	1.50	4.2.5	3.25	1.50	2.00

**Figure 4-3 Strong DTV Desired; NTSC Co-Channel Undesired**

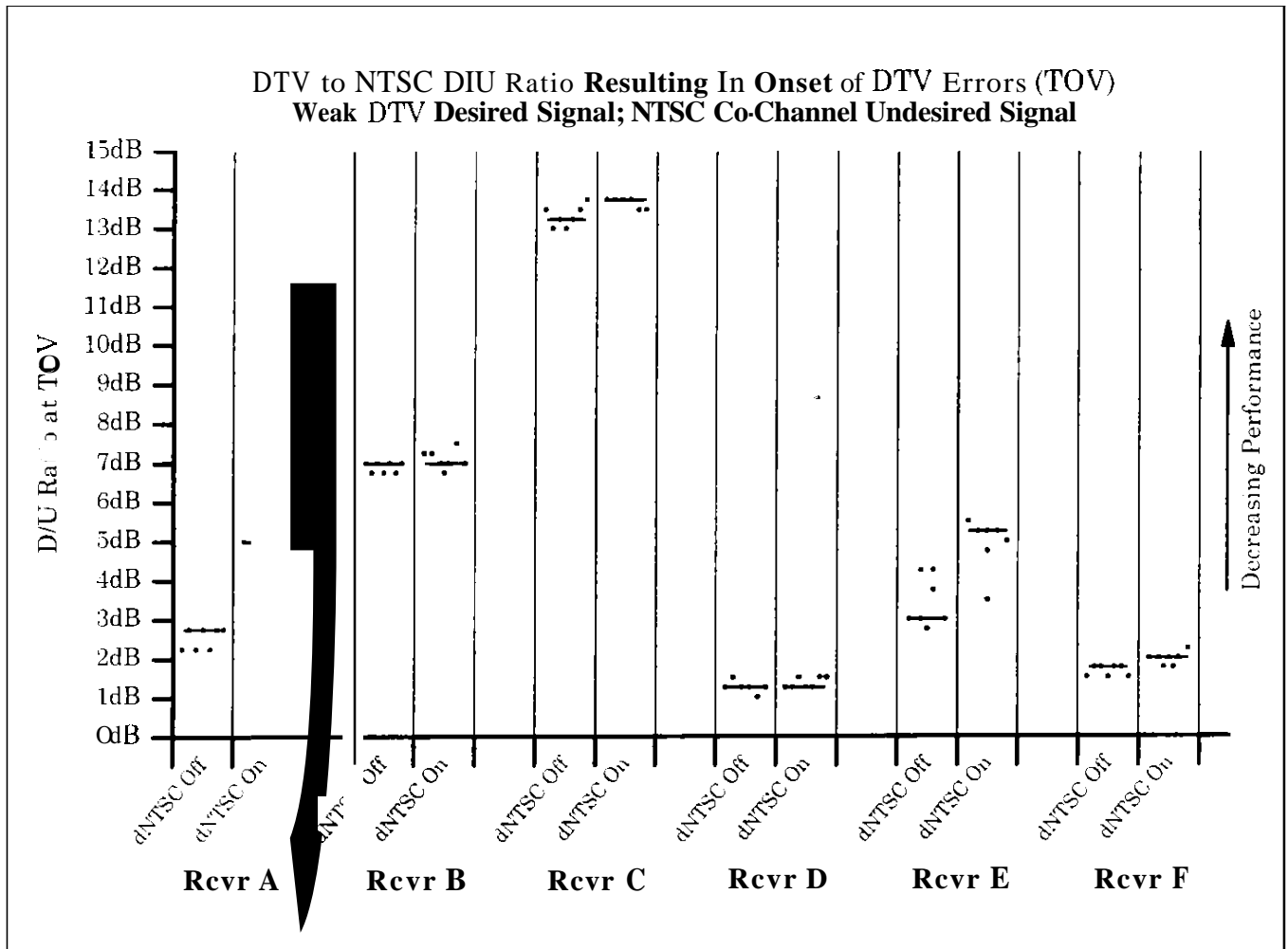
All Data On This Page Taken With -24dB dNTSC Injection**Table 4-6 Moderate DTV Desired: NTSC Co-Channel Undesired**

	Revr A		Revr B		Revr C		Revr D		Revr E		Revr F	
	dNTSC Off	dNTSC On	dNTSC Off	dNTSC On	dNTSC Off	dNTSC On	dNTSC Off	dNTSC On	dNTSC Off	dNTSC On	dNTSC Off	dNTSC On
D/U(dB) at TOV (Median)	2.00	4.25	3.00	3.25	13.25	13.26	1.26	1.50	4.00	4.75	1.00	1.50

**Figure 4-4 Moderate DTV Desired; NTSC Co-Channel Undesired**

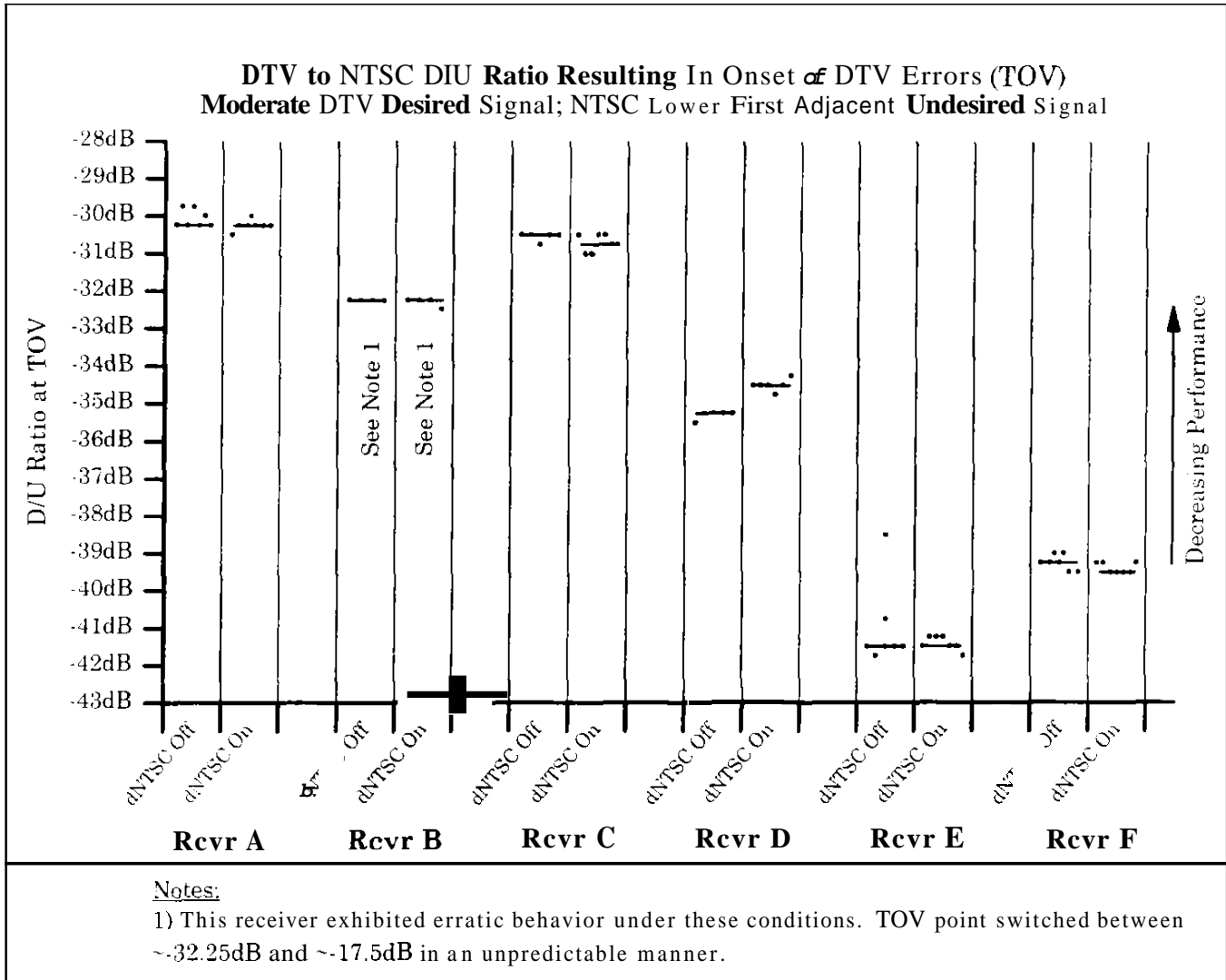
All Data On This Page Taken With -24dB dNTSC Injection**Table 4-7 Weak DTV Desired; NTSC Co-Channel Undesired**

	Rcvr A		Rcvr B		Rcvr C		Rcvr D		Rcvr E		Rcvr F	
	dNTSC Off	dNTSC On	dNTSC Off	dNTSC On	dNTSC Off	dNTSC On	dNTSC Off	dNTSC On	dNTSC Off	dNTSC On	dNTSC Off	dNTSC On
D/U(dB) at TOV (Median)	2.75	5.00	7.00	7.00	13.25	13.75	1.25	1.25	3.00	5.25	1.75	2.00

**Figure 4-5 Weak DTV Desired; NTSC Co-Channel Undesired**

All Data On This Page Taken With -24dB dNTSC Injection**Table 4-9 Moderate DTV Desired; NTSC Lower First Adjacent Undesired**

	Rcvr A		Rcvr B		Rcvr C		Rcvr D		Rcvr E		Rcvr F	
	dNTSC Off	dNTSC On	dNTSC Off	dNTSC On	dNTSC Off	dNTSC On	dNTSC Off	dNTSC On	dNTSC Off	dNTSC On	dNTSC Off	dNTSC On
D/U(dB) at TOV (Median)	-30.25	-30.25	-32.25	-32.25	-30.50	-30.55	-35.25	-34.50	-41.30	-41.50	-39.25	-39.50

**Figure 4-7 Moderate DTV Desired; NTSC Lower First Adjacent Undesired**

All Data On This Page Taken With -24dB dNTSC Injection

	Rcvr A		Rcvr B		Rcvr C		Rcvr D		Rcvr E		Rcvr F	
	dNTSC Off	dNTSC On	dNTSC Off	dNTSC On	dNTSC Off	dNTSC On	dNTSC Off	dNTSC On	dNTSC Off	dNTSC On	dNTSC Off	dNTSC On
D/U(dB) at TOV (Median)	-33.75	-33.50	-41.00	-41.25	-29.75	-30.25	-35.50	-35.00	-40.50	-40.50	-39.00	-39.00

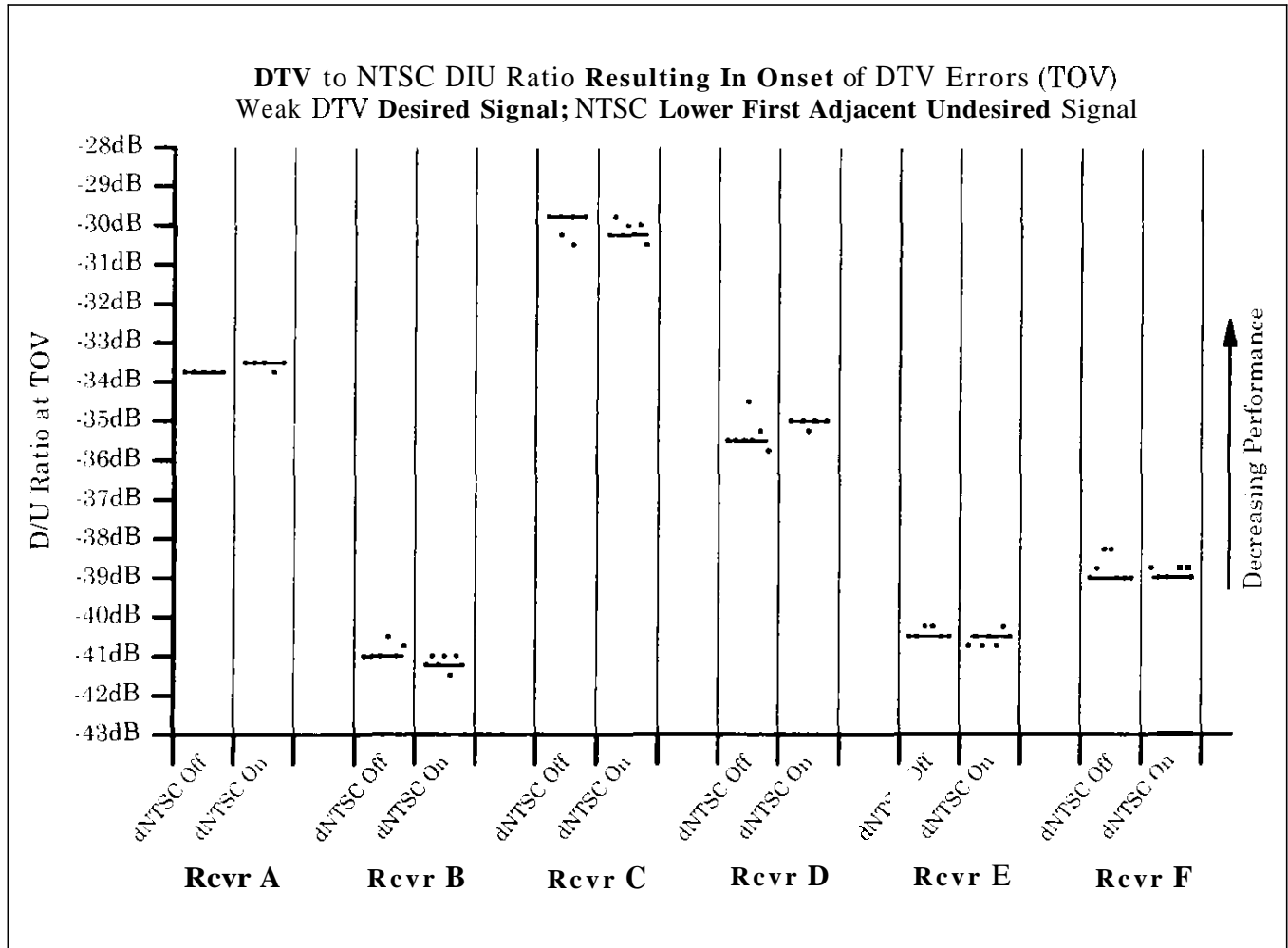
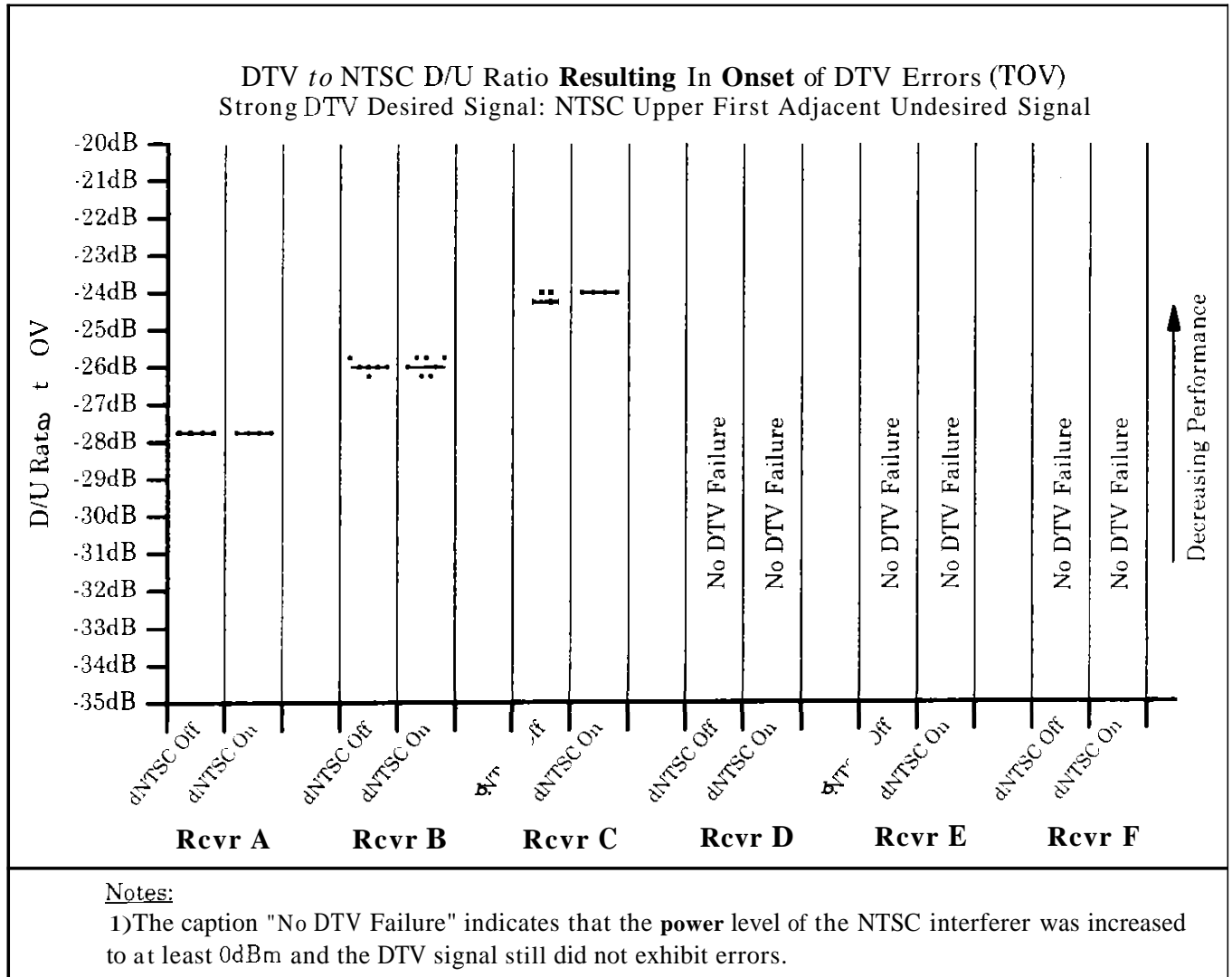


Figure 4-8 Weak DTV Desired; NTSC Lower First Adjacent Undesired

All Data On This Page Taken With -24dB dNTSC Injection**Table 4-11 Strong DTV Desired: NTSC Upper First Adjacent Undesired**

	Rcvr A		Rcvr B		Rcvr C		Rcvr D		Rcvr E		Rcvr F	
	dNTSC Off	dNTSC On	dNTSC Off	dNTSC On	dNTSC Off	dNTSC On	dNTSC Off	dNTSC On	dNTSC Off	dNTSC On	dNTSC Off	dNTSC On
D/U(dB) at TOV (Median)	-27.75	-27.75	-26.00	-26.00	-24.25	-24.00	No Fail	No Fail	No Fail	No Fail	No Fail	No Fail

**Figure 4-9 Strong DTV Desired; NTSC Upper First Adjacent Undesired**

All Data On This Page Taken With -24dB dNTSC Injection

Table 4-12 Moderate DTV Desired; NTSC Upper First Adjacent Undesired

	Rcvr A		Rcvr B		Rcvr C		Rcvr D		Rcvr E		Rcvr F	
	dNTSC Off	dNTSC On	dNTSC Off	dNTSC On	dNTSC Off	dNTSC On	dNTSC Off	dNTSC On	dNTSC Off	dNTSC On	dNTSC Off	dNTSC On
D/U(dB) at TOV (Median)	-29.00	-29.00	-32.00	-31.50	-36.75	-36.75	-32.25	-38.00	-38.75	-38.75	-18.00	-38.00

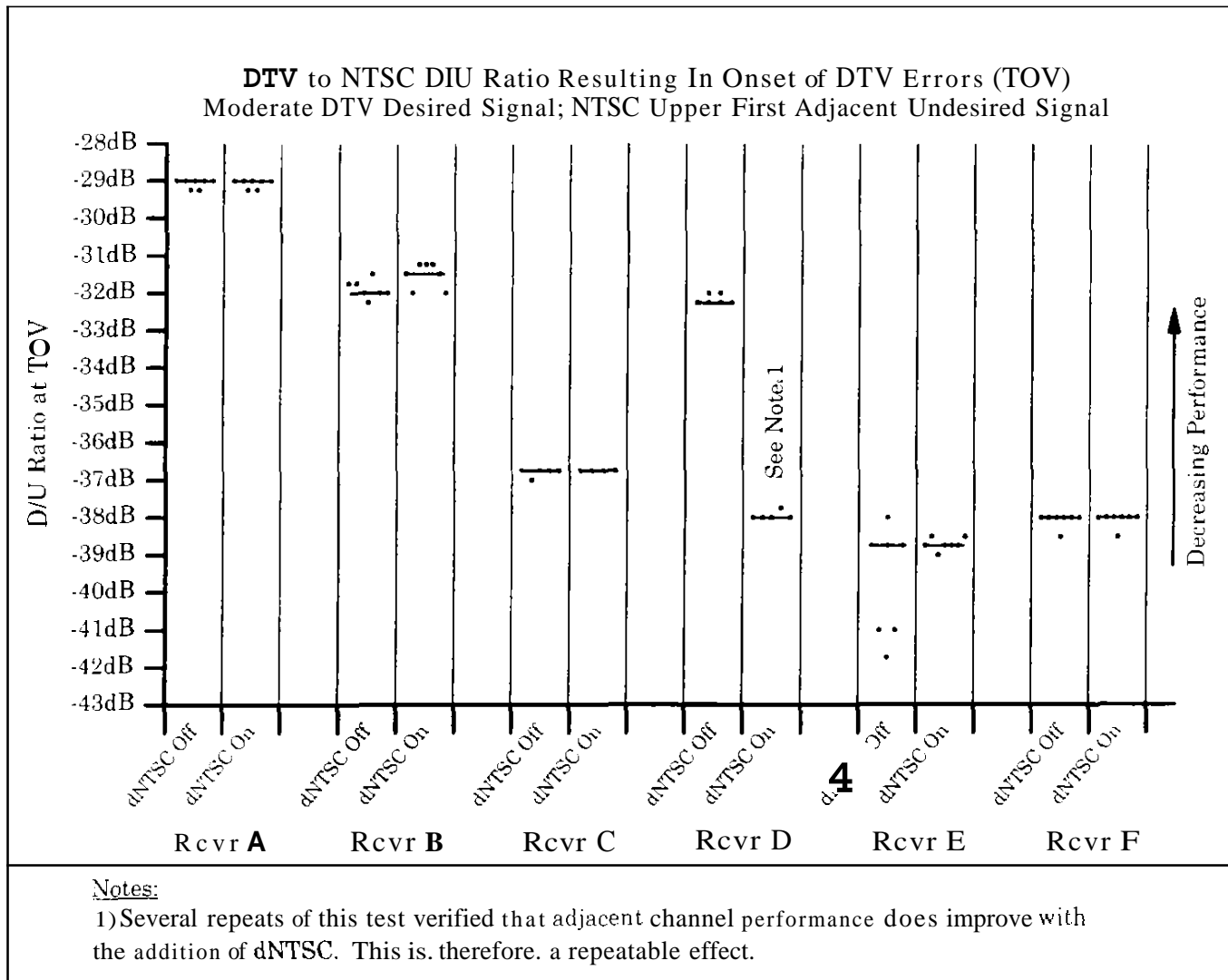
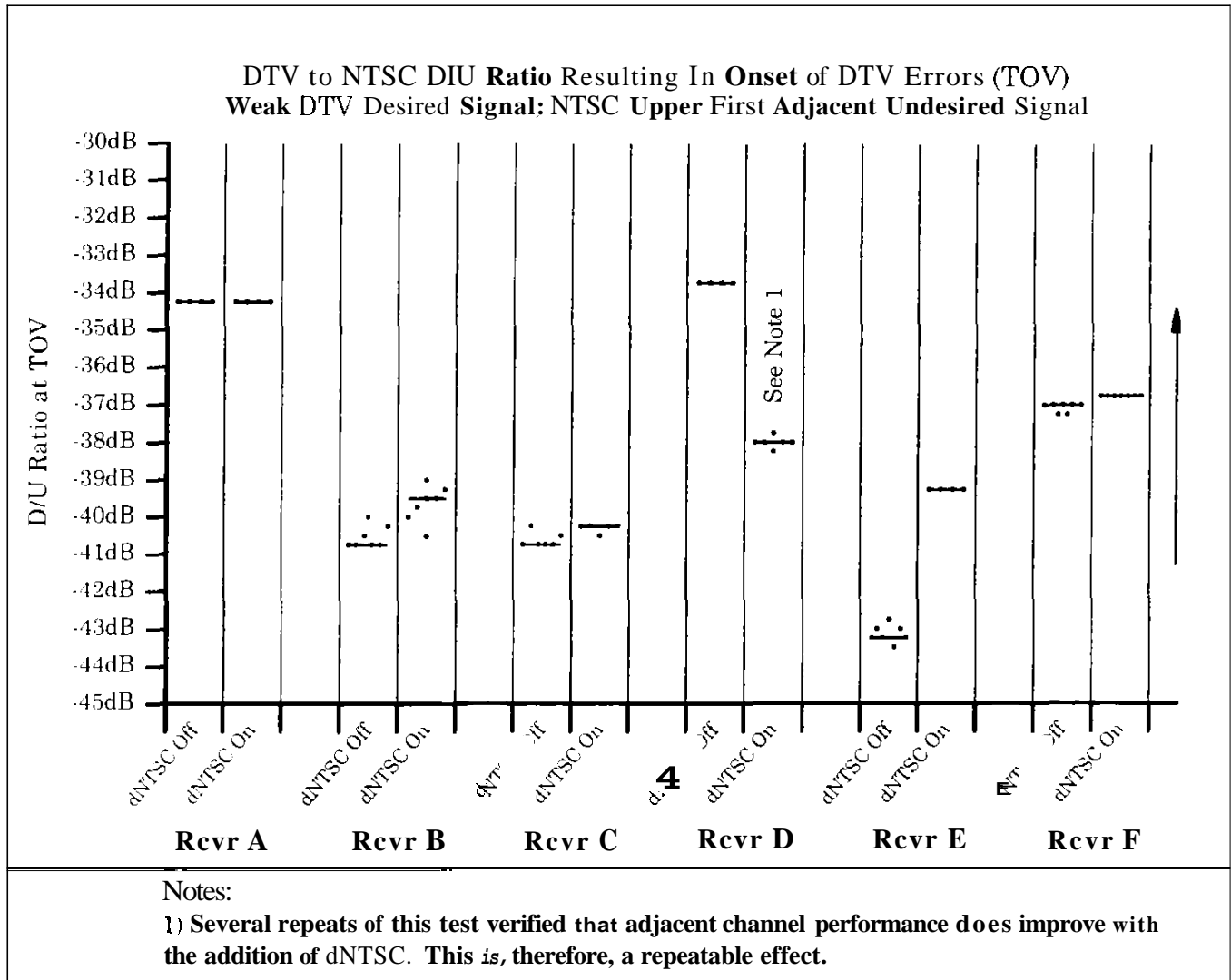


Figure 4-10 Moderate DTV Desired; NTSC Upper First Adjacent Undesired

All Data On This Page Taken With -24dB dNTSC Injection

D/U(dB) at TOV (Median)	Rcvr A		Rcvr B		Rcvr C		Rcvr D		Rcvr E		Rcvr F	
	dNTSC	dNTSC	dNTSC	dNTSC	dNTSC	dNTSC	dNTSC	dNTSC	dNTSC	dNTSC	dNTSC	dNTSC
	Off	On	Off	On	Off	On	Off	On	Off	On	Off	On
	-34.25	-34.25	-40.75	-39.50	-40.75	-40.25	-33.75	-38.00	-43.25	-39.25	-37.00	-36.75

**Figure 4-11 Weak DTV Desired: NTSC Upper First Adjacent Undesired**

4.2 Additional Test Results

As previously described in section 4.1, two receivers (Receiver **A** and Receiver E) were re-tested at a -26dB dNTSC visual injection level, in certain co-channel and upper adjacent interference conditions (note that the aural injection level was *unchanged*). These results were summarized in Figure 4-1, but are further broken down by **receiver** in the following plots and tables.

Table 4-14 Receiver A: Co-Channel Re-Tests At -26dB Injection

D/U (dB) at TOV	Strong DTV			Moderate DTV			Weak DTV		
	dNTSC Off	dNTSC On @ -24dB	dNTSC On @ -26dB	dNTSC Off	dNTSC On @ -24dB	dNTSC On @ -26dB	dNTSC Off	dNTSC On @ -24dB	dNTSC On @ -26dB
	2.50	4.75	4.00	2.00	4.25	3.50	2.75	5.00	4.25

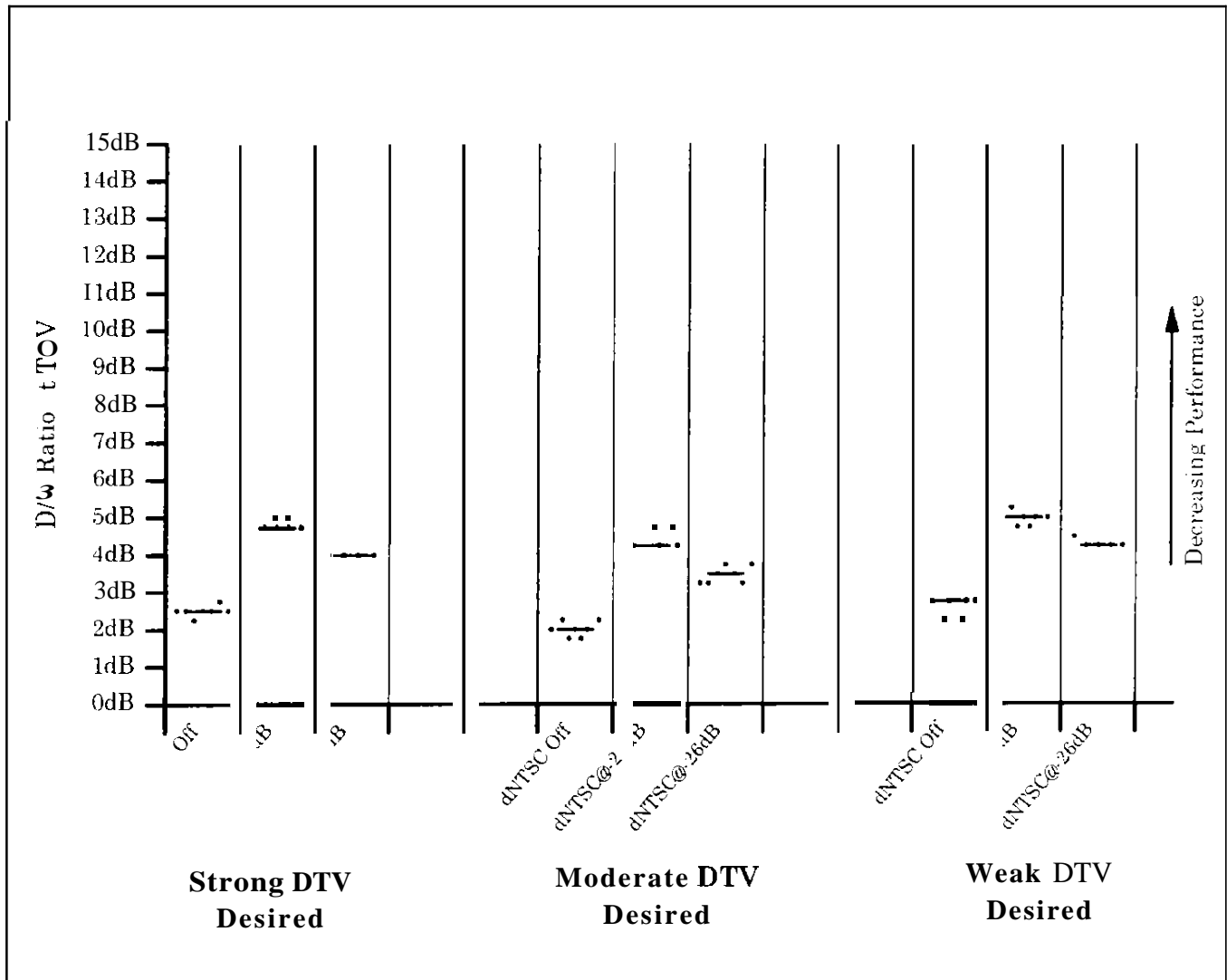


Figure 4-12 Receiver A: Co-Channel Re-Tests At -26dB Injection

**Table 4-15 Receiver E: Co-Channel
Re-Test At -26dB Injection**

D/U(dB) at TOV (Median)	Weak DTV		
	dNTSC	dNTSC	dNTSC
	Off	On @ -24dB	On @ -26dB
	3.00	5.25	3.50

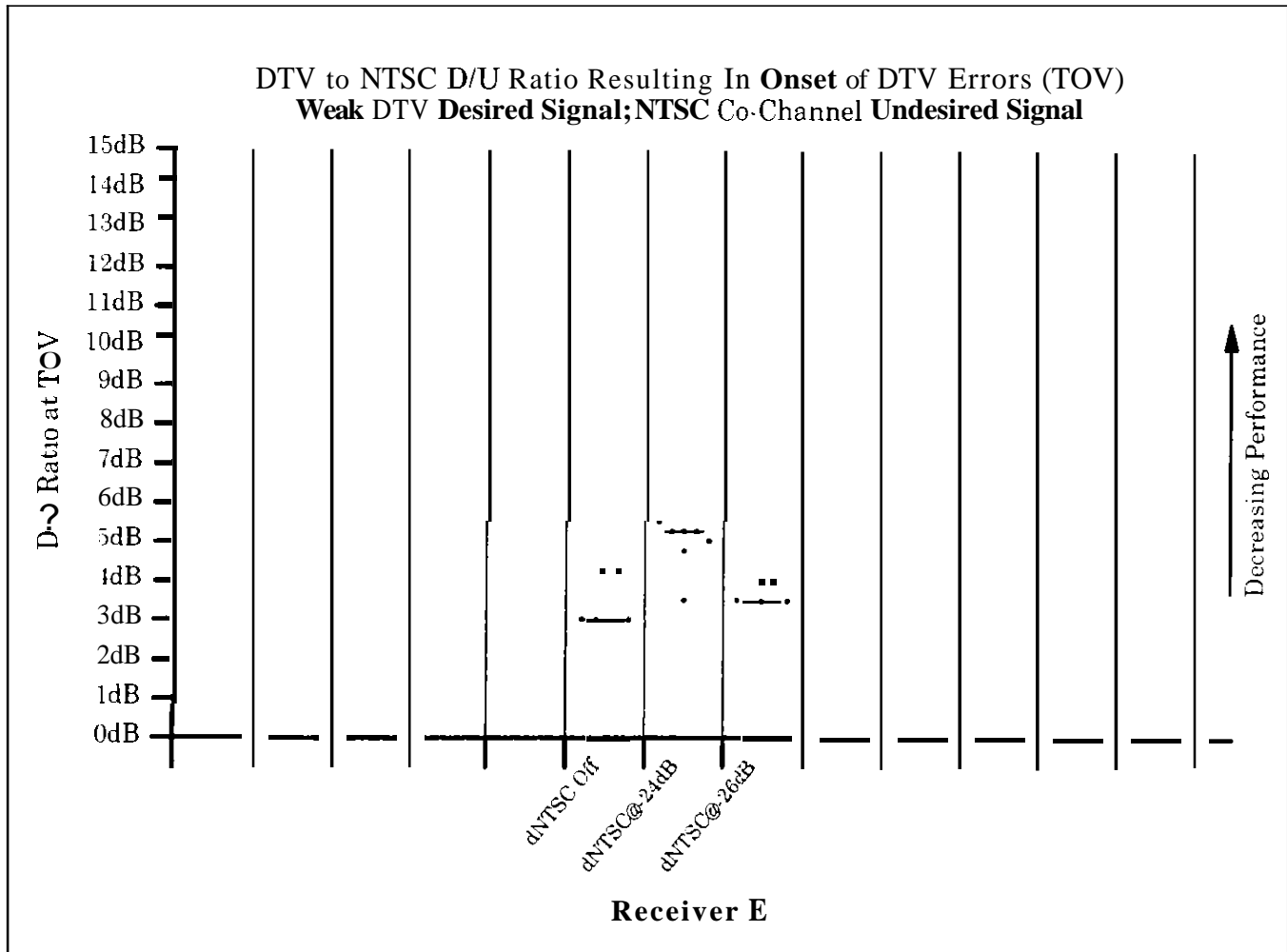


Figure 4-13 Receiver E: Co-Channel Re-Test At -26dB dNTSC Visual Injection

Table 4-16 Receiver E: Upper Adjacent Channel Re-Test At -26dB Injection

	Weak DTV		
	dNTSC Off	dNTSC On @ -24dB	dNTSC On @ -26dB
D/U(dB) at TOV (Median)	43 25	39 25	41 00

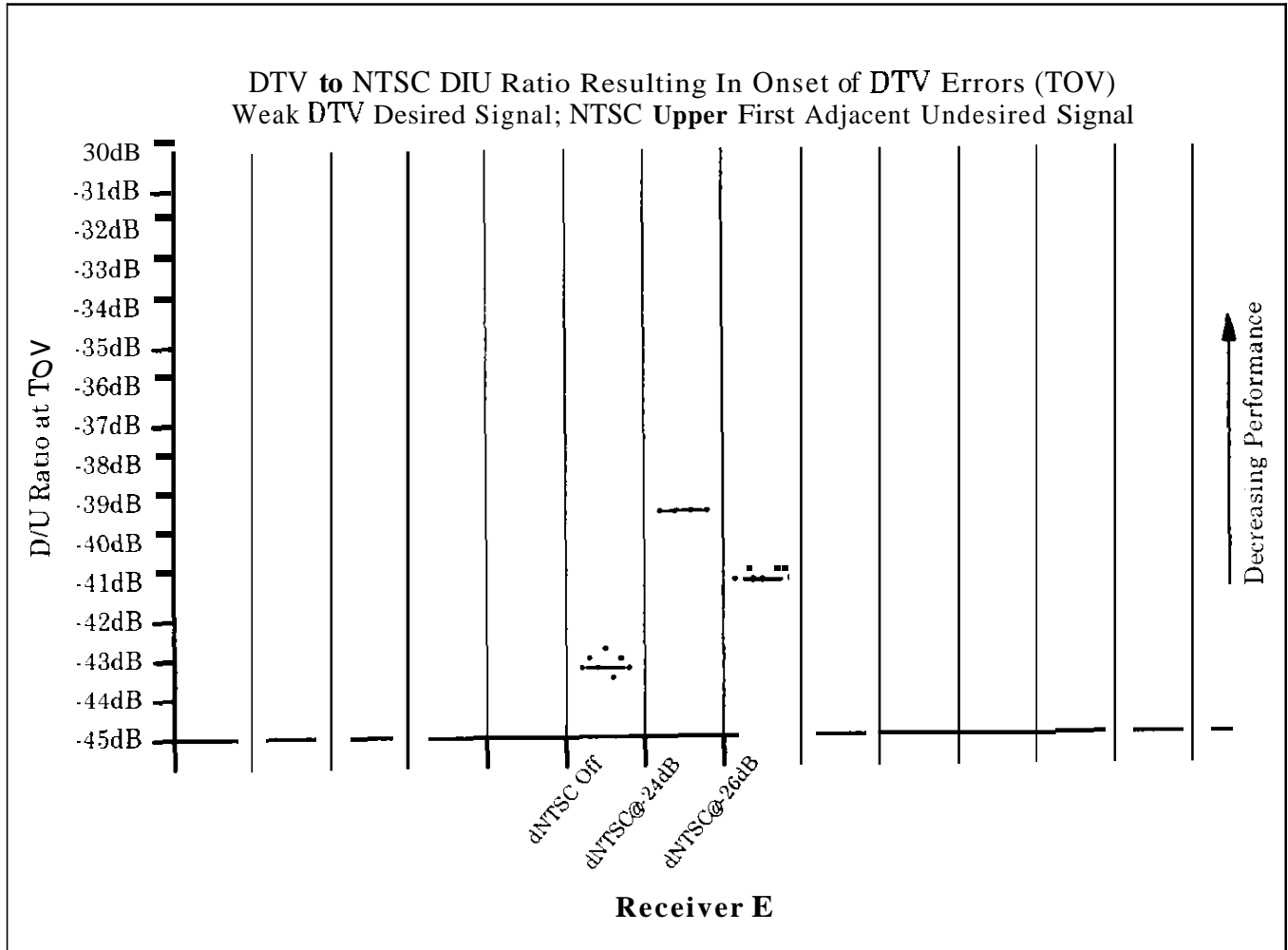


Figure 4-14 Receiver E: Upper Adjacent Channel Re-Test At -26dB Injection

Acknowledgements

The Advanced Television Technology Center (ATTC) and its staff are grateful to the representatives of Dotcast, Inc. for their support during this testing. ATTC wishes to thank Charles W. Rhodes for his expertise and guidance.

The ATTC is a private, non-profit enterprise formed by a coalition of broadcasting companies and industry organizations. The Advanced Television Technology Center (ATTC) has been providing independent test and measurement services to the broadcast industry for over eleven years. The **work** of the ATTC has been a key component of numerous broadcast industry standards and FCC rules and regulations. Through this work, the ATTC has earned an industry reputation of conducting fair and impartial tests in a manner that maintains the utmost technical quality.

For the testing of the Dotcast dNTSC System, ATTC project staff included: Paul K. DeGonia, *Executive Director* • Charles W. Einolf, Jr., *Deputy Executive Director* • Tom Boyer, *Radio/Television Engineer* • Debbie Espinoza, *Office Administrator* • Jake Kirkland, *Radio/Television Engineer* • Paul Manley, *Expert Viewer/Editor* • Ellyn Sheffield, *Sheffield Audio Consultants* • Oliver Sichelschmidt, *Radio/Television Engineer* • Steve Thomas, *Technology Specialist* • Sean C. Wallace, *Systems Engineer*